



Large Scale Networking

Impacts of PITAC 1999 Report

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PITAC Recommendations for Networking Research, February 1999

- Collect and analyze performance data, model and simulate network behavior
- Develop technologies: optical, wireless, satellite, and wired technologies
- Plan for scaling the Internet
- Develop middleware to enable large-scale systems
- Develop large-scale applications and the scalable services they require
- Fund a balanced set of testbeds and research infrastructure



Current Status of Federal Networking Research Programs

- Federal agencies have funded extensive research in each of the PITAC recommended areas
- Current Federal research programs emphasize:
 - Ubiquitous access, access from the edges
 - Extensibility: sensornets
 - Network management including end-to-end performance measurement
 - Wireless technologies
 - Optical networking
 - Middleware to enable scalability, applications, and network services



Federal Agency Accomplishments Based on PITAC Recommendations

- Supernet: Gigabit optical networking is operational
- End-to-end performance measurement on the Next Generation Internet (NGI)
- Web 100 middleware automates tuning the application/network interface
- More than 15 Gigabit applications have been demonstrated and documented
- DARPA, NSF, NIST, and NASA programs in wireless access



Planned LSN Programs, FY2002+

- LSN program plans for FY2002+ include:
 - Fundamental network research
 - Agile networking, optical networking, wireless
 - Access from the edges including mobile wireless
 - Trust/security/privacy
 - Automated network management
 - Revisit networking fundamentals, e.g., TCP/IP
 - End-to-end network performance measurement
 - Modeling and simulation of network behavior



Planned LSN Programs FY2002+, Concluded

- Enabling new classes of applications, e.g.,
 - Collaborative problem solving environments
 - Management of large-scale, distributed, multi-institutional systems
 - Telemedicine in a distributed, active, secure environment
- Testbeds
 - Refine standards and technologies
 - Bridge the gap between fundamental research and commercial products
 - LSN agencies in cooperation with university researchers and industry developers



Recommendation: Increase Funding for Scalable Information Infrastructure (SII)

Add \$60M in FY2000 . . . Add \$300M in FY2004

	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004
PITAC SII Budget Recommendations *	-	+60M	+120M	+180M	+240M	+300M
	Estimate	Estimate	Request			
LSN R&D Budget	291M	276M	334M			
Change from FY1999		-15M	+58M			
* Includes some increases for software development						



Issues and Concerns

- Fundamental research to scale the Internet to many orders of magnitude increases in nodes, users, network traffic
- Revolutionary research to adapt relevant science from other fields, e.g., chaos theory, stochastic processes, economics
- End-to-end trust, security, and privacy